

APPENDIX

FLWSHEETS FOR ICPP PROCESSES

Flowsheets for each of the processes used to recover uranium are shown in the following figures:

Figure A-1 is the flowsheet for the RaLa process. This process was used to recover barium-140 from freshly irradiated uranium in a fresh MTR fuel element. Even though the total amount of uranium product produced was not significant, it was a significantly different flowsheet from the other flowsheets, all of which used an acidic dissolution reagent. The process operated from 1957 to 1963.

Figure A-2 shows a typical flowsheet for the processing of aluminum clad fuels. It also shows the first cycle extraction process used for these fuels.

Figure A-3 shows a typical flowsheet for the dissolution and first cycle extraction of a typical zirconium clad fuel.

Figure A-4 shows the dissolution process for the dissolution of the EBR-II stainless steel clad fuel.

Figure A-5 shows a typical first cycle extraction for stainless steel fuel from the EBR-II reactor.

Figure A-6 shows the process used to dissolve and blend the zirconium clad fuel dissolver product with the aluminum clad fuel dissolver product.

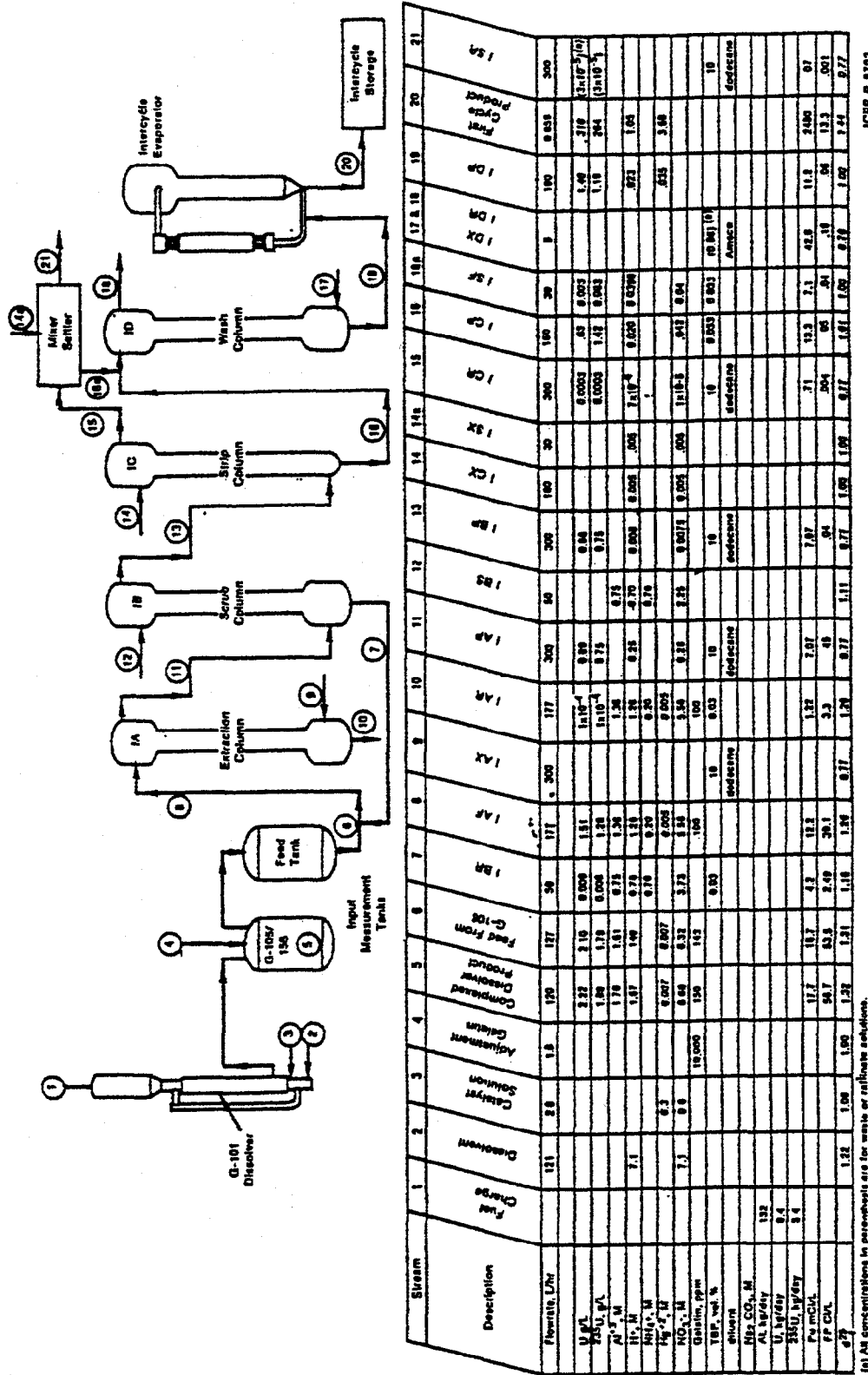
Figure A-7 shows the flowsheet for the combustion of ROVER graphite-based fuel.

Figure A-8 shows the flowsheet for the dissolution of the ash from the secondary burner in the ROVER fuel combustion flowsheet.

Figure A-9 shows the second and third cycle extraction systems. Stream 11a is the top water scrub used to increase the quality of the product.

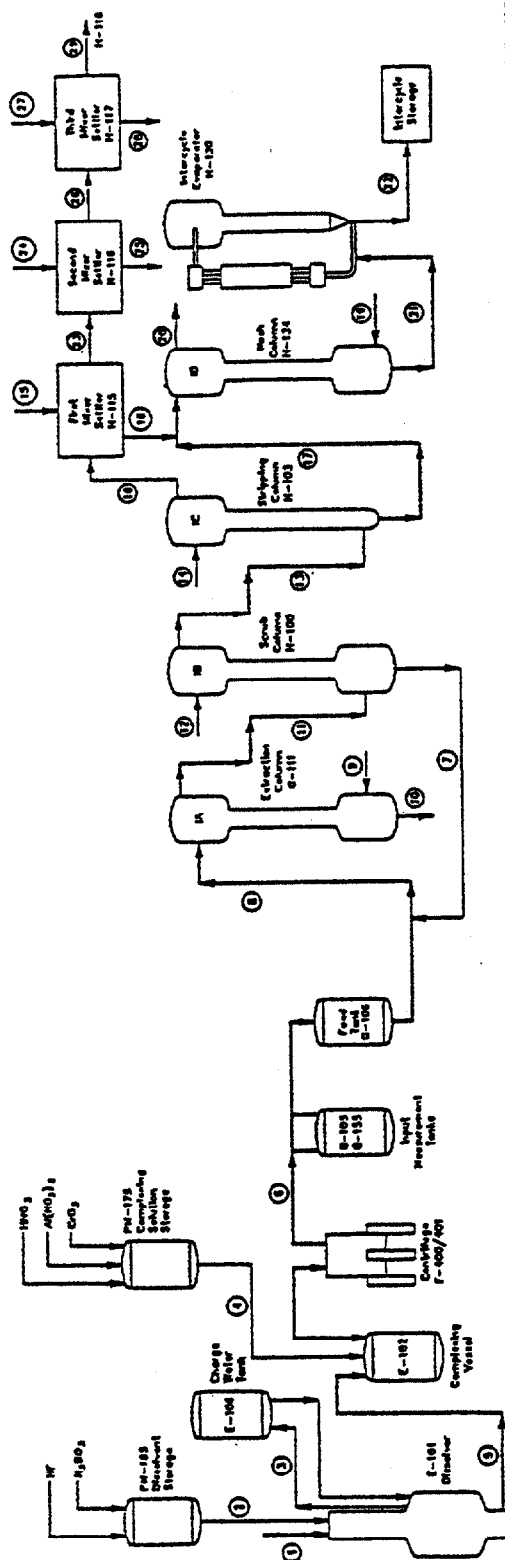
Figure A-10 shows the denitrator process for converting the concentrated uranyl nitrate solution into granular dry solid uranium trioxide. Since 1971, this process was used to prepare the final product for shipment as a solid. Prior to 1971, the product was shipped as uranyl nitrate solution in liquid shipping containers (L-10 bottles in a bird cage rack or as L-10 bottles in 110 gallon DOT 6M/2R shipping drums).

Figure A2



Processing Flowchart for Dissolution of Aluminum Fuels and First Cycle Solvent System Processing of the Aluminum Dissolver Product Campaign 38:

Figure A3

[illegible]

PH-100-100-100

(d) Based on 3.97 miles of seal consumed per male 2r.

a) Based on 3.92 miles of
b) Includes 5% lot dilution.
c) Continuous Source.

[a] Added in the form of D.O.
[b] Boiled on 12.1 hours of dissolution time. Charging time is approximately 8 hours.

Zirconium Processing Flowsheet for Campaigns 33 and 35.

Figure A4

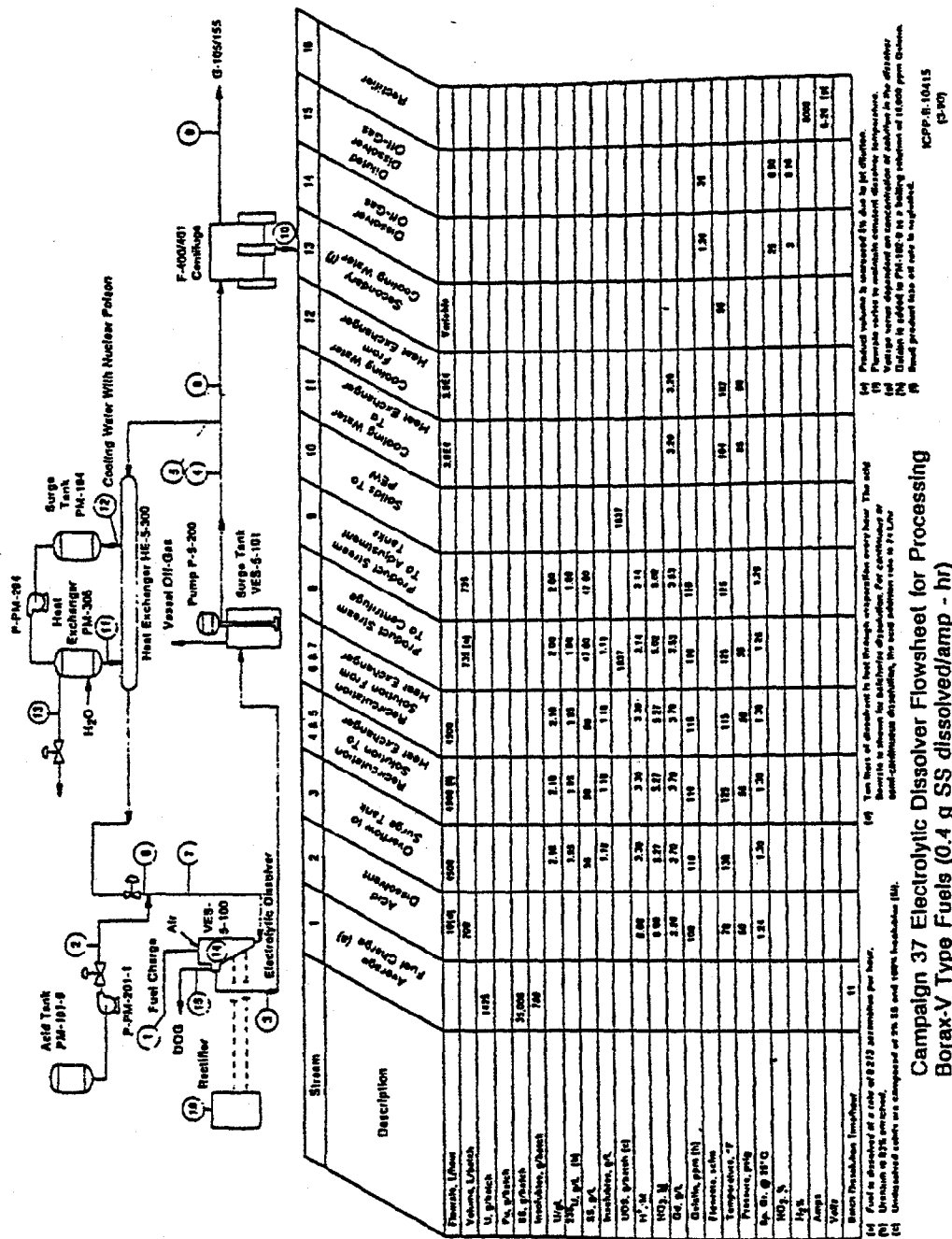
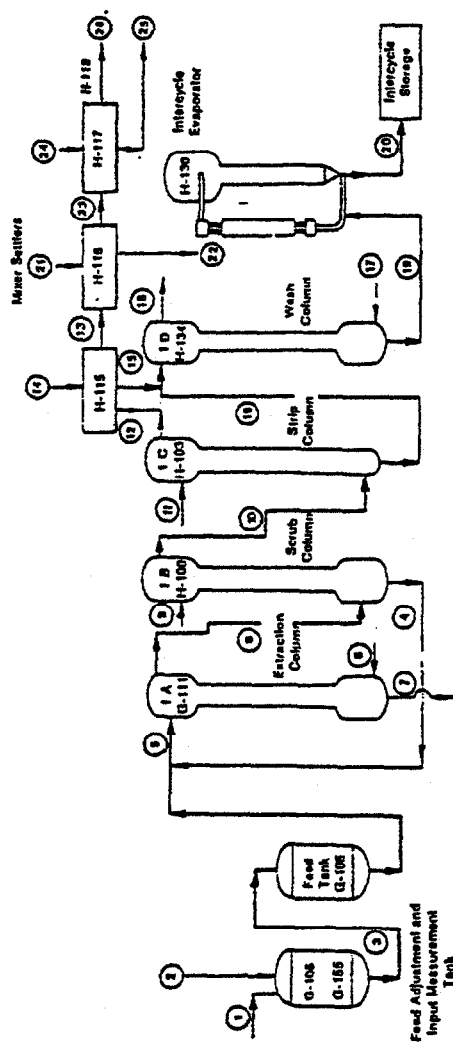


Figure A5



Stream	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17 & 18	19	20	21 & 22	23 & 24	24 & 25			
Description	Carburized Oxyster Product (a)	Water Adjustment		Adjusted Product (c)	I _{AS}	I _{AX}	I _{AY}	I _{AP}	I _{BS}	I _{BP}	I _{CX}	I _{CA}	I _{BA}	I _{SA}	I _{SY}	I _{CP}	I _{CS}	I _{DP} (g)	I _{CP}	Feed Grade Product	H ₂ S (a)	H ₂ S (b)	H ₂ S (c)	H ₂ S (d)	
		Water Adjustment	Adjusted Product (c)																						
Fluoride Liquid	85.50	31.10	105	44	140	300	149	300	44	300	200	300	300	30	30	200	200	5	230	3.61	30	300	30		
H ₂ SO ₄	3.36		2.10	0.89	1.75		1.34	0.21	(-0.70)	0.005	0.005			0.24	0.24	0.013			0.917	0.97			0.04		
H ₂ O	7.20		4.70	3.85	4.39		3.48	0.24	2.25	0.005	0.005			0.94	0.94	0.081			0.084	3.80			0.01		
U ₂ O ₈	16.30		10.60	0.045	7.46		1.1x10 ⁻³	3.72				6.6x10 ⁻⁴		9.2x10 ⁻³	9.2x10 ⁻³	5.91			4.86	310	1.6x10 ⁻³				
H ₂ O ₂	10.90		7.10	0.030	4.99		1.1x10 ⁻³	2.48				6.3x10 ⁻⁴		5.3x10 ⁻³	5.3x10 ⁻³	3.85			3.25	2.07	1.0x10 ⁻³				
SS, g/L	70		46		32		32																		
Na ⁺ , g/L	0.48		0.20		0.21		0.21																		
Ca, g/L	1.99		1.30		0.92		0.92																		
Fishum, g/L	0.86		0.56		0.40		0.40																		
Al ³⁺ , M				0.75	0.22		0.22		0.75																
Mg ²⁺ , M				0.70	0.21		0.21		0.70																
TSP Vol %				0.03		10	0.03	10		10		10	10			0.034	(1.50)	6x10 ⁻⁴		0.034		10			
MgCO ₃ , M																									
Diluent																									
d ₂₅	1.36	1.00	1.23	1.16	1.21	0.77	1.10	0.76	1.11	1.00	1.00	0.77	0.77	1.00	1.00	1.01	0.75	1.01	1.45	1.01	0.77	1.00			

(a) A current utilization of 0.5 g is dissolved per ampere-hour was assumed.

(a) Quantum concentration in parenthesis are for the 11 SW. A current utilization of 0.5 g is dissolved per ampere-hour.

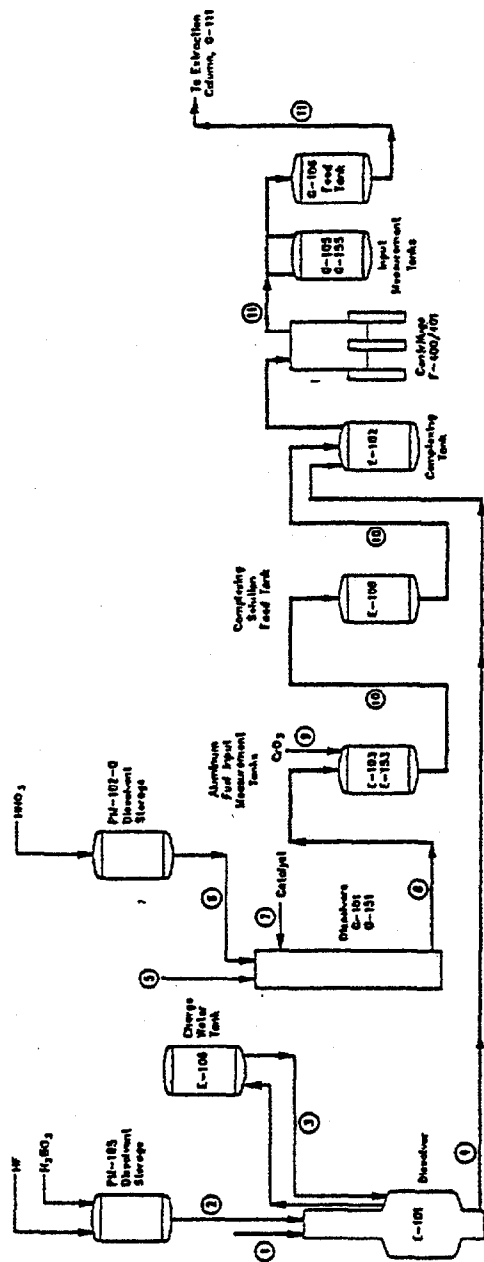
(c) Uranium concentration in fuel includes a 3% hot dilution.

(c) Includes a 5% jet dilution.

**Campaign 37 Flowsheet for Processing Dissolver Product Through
The First Cycle Extraction System with No Raffinate Recycle**

ICPP B.1042B
(3.90)

Figure A6

[illegible]

- (a) Corresponds to a batch of Zr and. This is the charge used in the first test. It was made up of 100 gms. of Zr and 30 hours of run time. Based on AIR type minimum.
- (b) Includes 100 t of charge water.
- (c) Flows after discharge time. Discharge time is 24 hours and charging time is 8 hours.
- (d) Based on anticipated acid consumption of 3.92 moles per mole of Zr .
- (e) Includes 52 t addition to transfer solution from E-103 to E-123 for 24 hours. This is the ferrous during charging.
- (f) The volume of water in the tank is 2000 gal. The volume ratio of decomposer to absorber is 1:1. Based on 1.005.

100-2-1314
(4-194)

Coprocessing Dissolver Flowsheet for Campaign 30: PWR-ATR Fuels.

Figure A7

Description	Stream							
	1	2	3	4	5	6	7	8
	Primary Burner Grinder & Purges (c)		Primary Burner Product		Secondary Burner Jet Grinder & Purges (b)		Secondary Burner Jet Filter Cooling Nitrogen (b)	
Total U, Kg/day	20.6	20.6						20.6
UC ₂ , Kg/day	22.7							
NbC, Kg/day	13.2							
Mo, Kg/day	0.7							
Tubes, Kg/day	24.5							
Graphite, Kg/day	103.6	7.7						0.9
U ₃ O ₈ , Kg/day		19.5						18.4
Nb ₃ UO ₁₀ , Kg/day		11.8						14
Nb ₂ O ₅ , Kg/day		9.8						8.4
MoO ₃ , Kg/day		1.0						1.0
Al ₂ O ₃ , Kg/day	1.3	1.3						1.3
Total Solids, Kg/day	166	51.1						44
CO, SCFM (a)		1.2						0.2
CO ₂ , SCFM (a)		3.7						1.70
O ₂ , SCFM (a)	34	35.3	2.9	0.04				4
N ₂ , SCFM (a)	1.0	2.8	3.6	0.16	12	18.6		
H ₂ O (g) SCFM (a)		0.38						
Total Gas, SCFM (a)	35	74	6.5	0.20	12	20.9		

- (a) Standard conditions are 21.1°C and 1 atmosphere pressure.
- (b) The gas flows are averaged for the period during which burning is occurring in the secondary burner.
- (c) The Secondary burner is operated with batches of ash received from vessel 103.
- (d) The superficial gas velocities during burning are .9 ft/sec with 100% oxygen and 1.0 ft/sec with 100% oxygen for the primary burner and 0.6 ft/sec for the secondary burner.
- (e) The jet grinders will probably not be used and the gas flow in this flowsheet is only for instrument purges.
- (f) If the secondary burner jet grinders are used, a maximum flowrate of 2 SCFM of air could be used.

Figure A8

Stream		9	10	11	12	13	14	15	16								
Description		Ash Dissolver (a) (b)		Nitric Acid Dissolver		Nitric Acid Dissolver Product		HF Dissolver		HF Dissolver Product		Borated Water (e)		Complexant		Complexed Dissolver Prod. (d)	
		Solution volume, L/batch															
	U, g/L	125	126	75.7	201	177	252	640									
	²³⁵ U, g/L		62.0		51.1			16.1									
	Nb, G/L (e)		57.6		47.5			15.0									
	H ⁺ , M				24			<7.40 (c)									
	NO ₃ , M	2.6	1.98	19.5	7.67			2.40									
	F ⁻ , M	2.6	2.46		1.54		6.6	3.08									
	B, g/L			19.5	7.3			2.29									
	Al ³⁺ , M	4.5	4.5	4.5	4.5	4.5		2.66									
	Mo, g/L		2.66		1.67			0.89									
	d ₂₅	1.08	1.14	1.12	1.19	1.00	1.34	1.19									
	U ₃ O ₈ Kg/ batch		0		0		0										
	Nb ₃ UO ₁₀ , Kg/batch		7.0		0.02			0.02									
	Nb ₂ O ₅ , Kg/batch		4.2		1.4			> 1.4(c)									
	Graphite, Kg/batch		0.4		0.4			0.4									
	Al ₂ O ₃ , Kg/batch		0.7		0.7			0.7									
	MoO ₃ , Kg/batch		0.55														
	Total solid, Kg/batch	22	12.4		2.4			2.4								2.4	
	Fission Product mCi/L		15		9.7			3.3								3.3	
	Plutonium μ Ci/L		21		17.8			6								6	

(a) The ash charge will probably be in the range of 16 to 22 Kg. The same amounts of reagents should be used if the ash charge is less than 22 Kg.

(b) There will be two batches per day added to the dissolver.

(c) Some of the niobium will precipitate as NbO₂F during the complexing step.

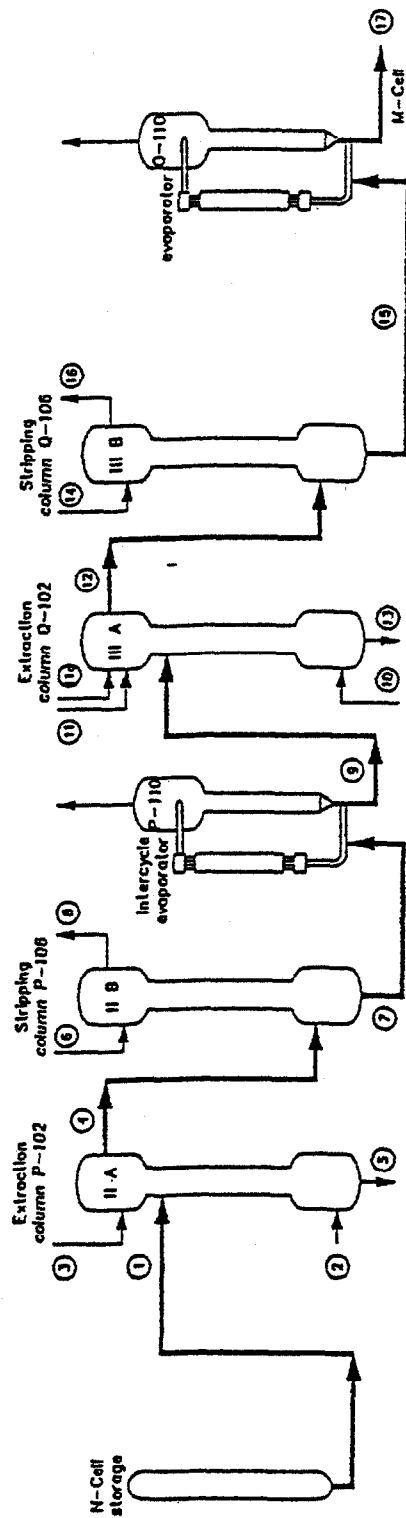
(d) Includes 5% jet dilution for transfer of solution 13 to the Complexer tank

(e) Borated water added to maintain temperature of complexed dissolver product below 40°C

ICPP-A-10956
(8-86)

Campaign 37: Flowsheet for Dissolution of ROVER Ash

Figure A9

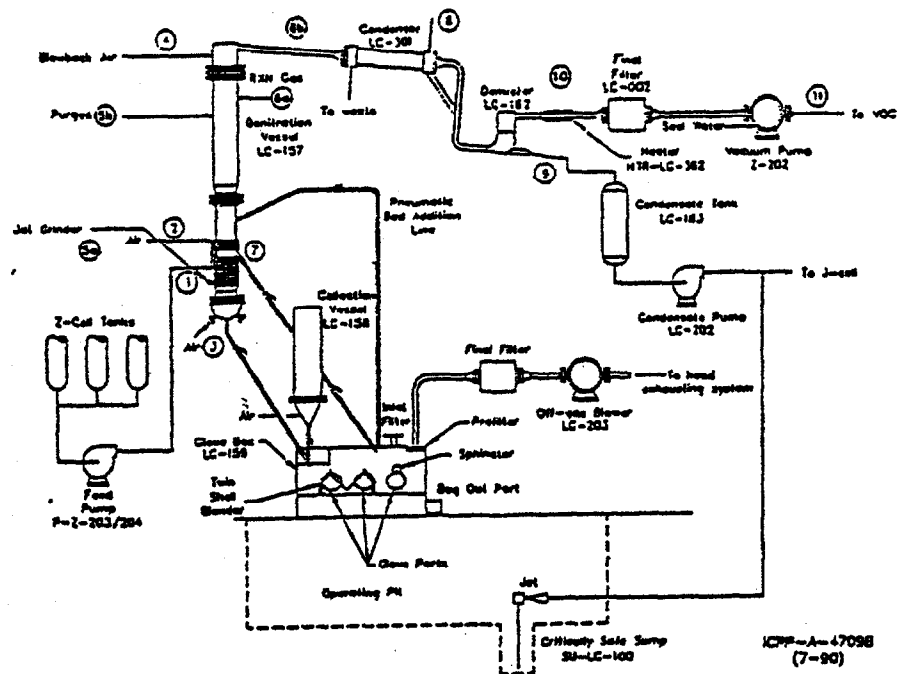


Stream	1	2	3	4	5	6	7	8	9	10	11	11a	12	13	14	15	16	17
Description	II AF	II AX	II AS ₁	II AP	II AR	II BX	II BP	II BR	Second Cycle Product	III AX	III AS ₁	III AS ₂	III AP	III BX	III BP	III BR	Product	
Flowrate L/hour	45	40	45	51	50	30	45	45	2.74	45	37	45	50	30	30	45	7.56	
Sp. Gr.	1.46	0.90	1.31	1.24	1.00	1.16	0.90	1.47	0.80	1.32	0.80	0.91	1.24	1.00	1.16	0.90	1.64	
Extraction									Hezene			Hezene				Hezene		
Al(NO ₃) ₃ M				1.57							2.10		1.55					
HNO ₃ M	0.52			0.007				0.10				0.016		0.02	0.044		0.16	
Mt, Cl, M				0.32							0.16		0.16					
Mt, NO ₃ M				0.11									0.004					
U, g/L				<5x10 ⁻¹				390					<5x10 ⁻¹			114	<5x10 ⁻³	450
Fe (SO ₄ , NH ₄) ₂ M	310			0.03							0.02		0.01					
(NH ₄ , NH ₃) ₂ M				0.06							0.01		0.03					

ICPP-A-10419
(8-90)

Campaign 37 Second and Third Cycle Extraction Flowsheet for High Uranium Concentration Feed

Figure A10



Stream (a)	1	2	3	4	5a	5b	6a	6b	7	8	9	10	11
Description	Liquid Nitrogen Feed Solution	Atomizing Air (g)	Reducing Air (g)	Blowback Air (g)	Jet Gas/air	Tail Pipe Air to Denitrator	Denitrator Gas (g)	Total Off-Gas	Product Oxygen	Co-composition Products	Condensate	Off-Gas To HCA Filter	Off-Gas To HOD
Liquid Flow, Liter/hr	4 (b)								1100	2.50			
Gas Flow scfh (d)		64	378	38	111	60	183	231				708	708
Supply Pressure, psig		40	40	100	100	20			50				
Supply Temp., °F	78	70	620	70	70	70			58				
Gas Flow scfh (e)		153	346	53	274	197	455	1167				1567	1197
Process Pressure, psia		11.60	12.50	8.50	11.80	10.70	10.70	6.50	10.70		6.50	7.50	12.20
Process Temp., °F		572	620	265	572	572	572	288		58	110	265	265
O ₂ , g-M/hr		16	98	1.60	27	15	7.80	167.40				167.40	167.40
N ₂ , g-M/hr		80	250	32	102	56		609				609	609
NO, g-M/hr			--				7.80	7.80			2.40	5.20	5.20
NO ₂ , g-M/hr							8.20	8.20			2.80	5.70	5.70
H ₂ O, g-M/hr	191						181	181			138	52	52
UO ₂ , Kg-M/hr	2.16								2.16		Trace	Trace	

(a) Number refer to Figure 10.

(b) Nominally 490 g/L, 8.17 M HNO₃ 1.82 Sp/L concentrations may vary from 100 to 500 g/L.

(c) Standard conditions are 70° F and 14.7 psia. Pressure in denitrator room is 12.5 psia.

(d) Nozzle to Air Ratio is 576 based on process pressure and supply air temperature (70° F).

(e) Superficial fluidizing velocity is 1.2 M/sec.

(f) Blowback every 5 minutes for 0.17 seconds.

(g) Co-composition Products.

(h) Actual gas flows were measured at the process conditions for temperature and pressure.

ICFP-A-47098
(7-90)Campaign 37 Denitration Flowsheet for Concentrated UO₂(NO₃)₂ Solutions

TRU and DU at SMC

Report on Mass Balance at SMC

Don C. Barg

June 19, 2000

1. Materials

The Specific Manufacturing Capability Project (SMC) is located at the north end of the Idaho National Engineering and Environmental Laboratory (INEEL). SMC processes large quantities of depleted uranium (DU) metal. Records show that SMC has received 10,129,000 pounds of DU for processing. Of this, 4,726,000 pounds were received from the Fernald, Ohio, plant, and 5,403,000 pounds were received from the DOE plant at Rocky Flats in Colorado. Approximately 6,385,000 pounds have been shipped to the customer (as of February 29, 2000). About 3,750,000 pounds of DU are stored at SMC or are at a recasting facility. This includes incoming material that has not been processed, processed material not yet shipped to the customer, and recyclable DU. Recyclable DU from the processing is sent to a privately contracted metallurgical facility for recasting. This happens from time to time, resulting in an efficient use of the original consignment of DU.

In addition to the material shipped, SMC produces an unavoidable quantity of waste DU material. This consists of laser fines (residues from laser cutting of the DU), and DU oxides from processes such as a water wash of processed material, sweepings, and so on. A best estimate of the quantity of waste material as of the end of February 2000 is approximately 93,000 pounds of DU. Roughly half of the laser fines have been shipped for re-use. The remainder of the material remains at SMC.

SMC uses a single HEPA-filtered stack emissions system, with post-filter monitoring for any effluent releases. Data for 1985-1989 are not presently available, and the final report for 1999 is not yet complete. Based on the data for 1990-1998, and normalizing this to the entire duration of the project, SMC has released approximately 0.25 pound of DU to the atmosphere from the beginning of the project to the present day. This is a negligible amount of material. DU and DU oxides are heavy and dense. No environmental sample collected outside the SMC fence has ever detected any DU from SMC.

The DU at SMC is 0.2% by weight U-235, about 0.0005% by weight U-234, and nearly all the rest is U-238. Small quantities of other elements, such as carbon, nickel, iron, zirconium, silicon, titanium, and aluminum have been reported in the "parts per million" range. The highest aggregate of these trace elements has been about 290 ppm.

2. Transuranics and Fission Products

In August of 1999 it was reported to SMC that low concentrations of transuranic and fission product materials could be present in the DU used at SMC. Some very limited samples where data already were available were evaluated, and Am-241, Pu-238, and Pu-239/240 were found to be present. These first samples were not analyzed for Np-237 or Tc-99. The results suggested that a systematic sampling of available DU billets would provide useful information. Sixty samples were therefore collected from DU billets located at SMC: 20 from billets remaining from the original consignment (referred to as Population #1); 30 from the first recasting (Population #2); and 10 from the second recasting (Population #3). Approximately half of the Population #1 samples were from Rocky Flats billets, and the others were from Fernald billets. The results were reported to SMC in BBWI Internal Report INEEL/INT-99-01228, dated December 15, 1999. A qualitative analysis of the results has shown that there is no tendency for TRU or Tc-99 to migrate either to the upper portion of billets or to the lower portion. The only variation is random and is neither chemically nor physically driven. A second, more complete statistical analysis (INEEL Internal Memo JJE-00-01) shows that TRU quantities are quite consistent throughout the TRU measurements (with statistically likely random outliers being present). The Tc-99 concentrations are far more widely distributed. Maximum, minimum, and average values for the various radioactive materials are listed in Table 1. This table lists values both in terms of pCi per gram of DU and of grams of material per gram of DU. The values given in Table 1 are taken from INEEL/INT-9901228.

Table 1

Nuclide	pCi/g		g/g			
	maximum	minimum	Average	Maximum	Minimum	Average
Np-237	3.73	1.14	1.82	5.29E-09	1.62E-09	2.58E-09
Pu-238	2.05	0	0.272	1.20E-13	0	1.59E-14
Pu-239/240	2.66	0	0.406	4.28E-11	0	6.55E-12
Am-241	19.24	0	2.78	5.61E-12	0	8.10E-13
Tc-99	537	64	154	3.16E-08	3.78E-09	9.06E-09

The average value of the combined TRU material is 2.59 E-09 gram of TRU per gram of DU, or 2.59 parts per billion (ppb), and the maximum combined value of TRU per gram of DU is 5.34 ppb. Technetium-99 is also in the ppb range, as shown.

Processing of DU at SMC consists of rolling and cutting billets. These processes do not affect TRU concentrations in any way.

In the recasting process, the decay products (Th-234 and Pa-234m) move to the top of the molten DU and are skimmed off in slag. However, the TRU isotopes are nearly the same atomic weight and chemical characteristics as uranium. TRU is neither concentrated nor diluted in the recasting process, and no chemical processing beyond recasting takes place. SMC requires that only SMC metallic DU be used in the recasting process, and records of

materials returned to SMC affirm that this material is exclusively for the SMC process. SMC Quality Engineers and Inspectors make at least two visits to the recasting facility annually for overall quality control. These visits also confirm that no processing or additions are made to SMC DU. No change in concentrations from recasting or SMC processing has been observed, or is expected. Samples from the original shipment, from the first recasting, and from the second recasting have not shown a significant reduction in the amount of TRU or Tc-99 present in the samples.

3. Dose Evaluation

Derived Air Concentrations (DAC) for TRU materials are reported as 0.0067 of the DAC for uranium isotopes (see 10 CFR 835, Appendix A). The DAC is defined as the atmospheric concentration of a nuclide that, if breathed continuously at a standard breathing rate for a full working year of 2000 hours per year, could result in an internal committed effective dose equivalent (CEDE) of 5000 mrem. The estimated dose from inhalation of DU with the TRU constituents reported is calculated to increase by a factor of 0.0022. The derivation of this factor is shown in Appendix A of this report. Stated more clearly, a person who receives an internal dose (over 50 years) of 100 mrem CEDE from an intake of DU would have an additional internal dose from the intake of TRU in the DU, of 0.22 mrem. Such a dose is less than the statistical fluctuations inherent in sampling, counting, and evaluation.

SMC has conducted an extensive bioassay program since the earliest days of the project. At first, fecal samples were collected. No positive results were ever obtained. SMC also asked employees to be counted in a whole-body counter and lung counter. This also provided only negative results. At the same time, employees were asked to submit urine samples for analysis. Using state-of-the-art technology, the urine samples detected low concentrations of uranium in some individuals, at levels far below the minimum detectable levels for whole-body counting. The INEEL Internal Dosimetry Technical Basis Document, published in 1999, gives Minimum Detectable Activities for plutonium nuclides. The MDA for Pu-239/240 is $2.7 \text{ E-}08 \text{ } \mu\text{Ci/ml}$. This could give an estimated dose of 48 mrem CEDE. No plutonium or other TRU uptakes have ever been detected by any system at SMC. The urine bioassay program has continued throughout the duration of the SMC project.

During 1999 the maximally exposed SMC worker received an internal dose from inhalation of DU, of 48 mrem CEDE. The urine sample with the maximum single result was also analyzed for the possible presence of plutonium. The reported result was below the statistical variation, and no plutonium dose could be assigned. This agrees with the evaluation described in Appendix A. SMC does not currently collect fecal data for analysis. The reported results of this bioassay sample are attached to this report.

The maximum internal dose received at SMC was about 150 mrem CEDE, in 1988. This was from DU only. Based on the information presently available, an additional calculated dose of 0.3 mrem would be assigned to this individual from TRU/Tc-99.

The maximum number of employees at SMC is about 500, in the late 1980s. Presently the employee population is about 225. It is estimated that between 1000 and 1500 people may have been employed at SMC over the life of the project to the present time. Not more than half of these have been potentially exposed to DU and its constituents.

4. Licensing

The recasting facility holds an NRC agreement state license to receive, process, and ship depleted uranium. In 1999, when the TRU issue was raised, the state authorized the facility to continue to possess DU through January 2000. This gave SMC and the recasting facility time to collect and evaluate samples. Based on the SMC evaluation submitted to the recasting facility and through them to the state and NRC, the license authorization has been extended until March 31, 2002. This is the original date of expiration for this license. The NRC and the state continue to evaluate the TRU/FP situation.

APPENDIX A

Increase in Dose from the Presence of Transuranics in Depleted Uranium

Table 1 of this report lists the average concentration of the various TRU components of DU. Each is listed in pCi of TRU per gram of DU. The sum of these averages is 5.288 pCi/g. The specific activity of DU is 3.6 E-07 Ci/g. Therefore the activity concentration of TRU in DU, in units of curies of TRU per curie of DU, is

$$\frac{5.288 \text{ pCi/g}_{\text{DU}}}{3.6 \text{ E-07 Ci/g}_{\text{DU}}} = 1.47 \text{ E+07 pCi/Ci}$$
$$= 1.47 \text{ E-05 Ci of TRU per Ci of DU} \quad (1)$$

The Derived Air Concentration (DAC) for TRU nuclides is 2 E-12 µCi/ml, and the DAC for uranium nuclides is 3 E-10 µCi/ml. The DAC is defined as the atmospheric concentration of a nuclide that, if breathed at a standard breathing rate for a full working year of 2000 hours, would result in an internal committed effective dose equivalent (CEDE) of 5000 mrem. So for equal amounts of DU and TRU in the body, the TRU gives an effective dose equivalent 150 times more than the DU.

As shown above, the total TRU activity in the DU at SMC is far below the DU activity. The effect of TRU on internal dose is found by multiplying the fractional activity of TRU as given in Equation (1) by 150. This gives

$$1.47 \text{ E-05 Ci/Ci} \times 150 = 2.20 \text{ E-03} \quad (2)$$

That is, for every rem of internal dose received from the DU at SMC, an additional 2.2 mrem of dose is received from TRU. An internal dose of 100 mrem would be increased to 100.22 mrem, and so on.

Table 1 also lists the maximum TRU concentrations in DU. To provide an upper bound to the possible increase in dose from TRU a second evaluation is needed.

The sum of the maximum TRU concentrations is 27.68 pCi/g (picocuries of TRU per gram of DU). All other factors in the above calculation remain constant. Therefore the internal dose for the maximum concentration case should be 27.68/5.288 of the dose for the average concentration. So for the maximum concentration, a dose amounting to 1 rem CEDE from DU alone would be increased to 1.1 rem + 1 rem, or 1011 rem. This is still only about a 1% increase in dose.

Although the mass fraction of Am-241 in TRU is less than the mass fractions of the other TRU nuclides, the activity fraction of Am-241 is significantly greater than the activity fractions of the other nuclides. Am-241 has over half of the total TRU activity in the samples collected at SMC. Am-241 is therefore the most restrictive isotope in the TRU

materials at SMC. Because of this it is desirable to give a separate analysis for Am-241. Only the maximum concentration will be discussed.

The maximum activity concentration of Am-241 in the DU samples at SMC was 19.2 pCi of Am-241 per gram of DU. The other factors in the calculations used for total TRU remain constant. We have

$$\frac{19.24 \text{ pCi/g}_{\text{DU}}}{3.6 \text{ E-07 } \mu\text{Ci/g}_{\text{DU}}} = 5.34 \text{ E+07 pCi/Ci}$$
$$= 5.34 \text{ E-05 Ci of Am-241 per Ci of DU} \quad (3)$$

Again, the DAC for Am-241 is $2 \text{ E-12 } \mu\text{Ci/ml}$, and the DAC for uranium nuclides is $3 \text{ E-10 } \mu\text{Ci/ml}$. So the effect of Am-241 on internal dose is found by multiplying the fractional activity of Am-241 by $(3 \text{ E-10}/2 \text{ E-12}) = 150$. This gives

$$5.34 \text{ E-05 Ci/Ci} \times 150 = 8.01 \text{ E-03} \quad (4)$$

The maximum concentration of Am-241 observed at SMC could therefore increase a one rem dose from DU, to 1.008 rem. This is less than a 1% increase.

The TRU found in DU at SMC thus contributes a negligible addition to the dose received from the DU itself.

APPENDIX B

Increase in Dose from the Presence of Tc-99 in Depleted Uranium

The average concentration of the Tc-99 constituent in DU is listed as 154 pCi of TC-99 per gram of DU. As stated in Appendix A, the specific activity of DU is 3.6 E-07 Ci/g. The activity concentration of Tc-99 in DU is

$$\frac{154 \text{ pCi/g}_{\text{DU}}}{3.6 \text{ E-07 Ci/g}_{\text{DU}}} = 4.28 \text{ E+08 pCi/Ci}$$
$$= 4.28 \text{ E-04 Ci of Tc-99 per Ci of DU} \quad (3)$$

The DAC for Tc-99 is 3 E-07 $\mu\text{Ci/ml}$, and the DAC for uranium nuclides is 3 E-10 $\mu\text{Ci/ml}$. So for equal amounts of DU and Tc-99 in the body, the Tc-99 gives an effective dose equivalent only 0.001 of the DU.

As shown above, the total Tc-99 activity in the DU at SMC is far below the DU activity. The effect of Tc-99 on internal dose is found by dividing the fractional activity of Tc-99 as given in Equation (3) by 1000. This gives

$$4.28 \text{ E-04 Ci/Ci} \div 1000 = 4.28 \text{ E-07} \quad (4)$$

That is, for every rem of internal dose received from the DU at SMC, an additional 0.43 microrem (μrem) is received from Tc-99.

The maximum concentration of Tc-99 in DU is listed as 537 pCi/g. The dose from the maximum concentration of Tc-99 should be increased (over that from the average concentration) by a factor of 537/154. Therefore, for a dose of 1 rem CEDE from DU alone, the additional dose for the maximum concentration of Tc-99 would be 1.5 microrem (μrem).

The Tc-99 found in DU at SMC thus contributes a negligible addition to the dose received from the DU itself.

Bechtel BWXT Idaho, LLC
BIOASSAY LABORATORY

SAMPLE RECORD SHEET - ACTINIDES

URGENT

Tracking Number: 00002954

Serial Number: 98J124

Name:

S Number:

Organization:

Area Abbreviation: SMC

Sample Type: Urine

Quantity: 400.00 mL

Date & Hour Sampled: 8/9/1999 1200

Sample Sent: 10/26/1999

Sample Received: 10/26/1999

Electronically Approved by C.W. FILBY on 11/3/1999

Hardcopy prepared on 11/3/1999

Comments: WAS 99H096 TOTAL U - Pu/U REQUESTED 10/26/99 AFTER POSITIVE RESULT

Isotopes(s)	Results \pm Rnd* : Tot**	MDA**	Units	Analyst
Pu-238	(+2 \pm 5; 5) E-09	+3.49e-9	μ Cl/spl	ARB
Pu-239/240	(-0.4 \pm 5.9; 6.2) E-09	+3.50e-9		
Am-241				
U-233/234	(+2.0 \pm 0.2; 0.4) E-07	+1.03e-8	μ Cl/spl	ARB
U-235/236	(+9 \pm 6; 7) E-09	+8.07e-9		
U-238	(+1.0 \pm 0.0; 0.2) E-06	+8.71e-9		

* "Rnd" is the estimated random uncertainty, reported as one standard deviation, 1s. "Tot" is the estimated total uncertainty, also reported as 1s. Small negative and other results \leq 2*Tot are interpreted by LMITCO as including "zero" or as Not Detected.

For results greater than 2*Tot but \leq 3*Tot, detection is questionable. Results greater than 3*Tot indicate detection.

** Minimum Detectable Amount. Based on ANSI 13.30 Standard equations.

SMC BILLETS

INTEC RADIOCHEMISTRY

**Troy Tranter
Dean Goodwin
Mike Evans
Ron Stone
Stacey Hill
Doug Thompson
Chris Oertel**

**Idaho National Engineering and Environmental Laboratory
P.O. Box 1625
Idaho Falls, Idaho 83415-3885**

Wednesday, December 15, 1999

CASE NARRATIVE

Introduction

The material analyzed for this project consisted of samples of depleted uranium metal received from the SMC manufacturing process

Results presented in this report include values for the following isotopes:

^{237}Np , ^{238}Pu , $^{239}\text{Pu}/^{240}\text{Pu}$, ^{99}Tc and ^{241}Am .

Following this narrative, the sections will include:

- Summary Data Pages (Form I)
- QA/QC Summary (Form II & III)

Sample Dissolution

Aliquots of the uranium metal (≈ 2 grams) were dissolved in batch contacts using approximately 50 mL of reagent grade 6 M HNO_3 and minimal heat. After dissolution and cooling, the samples were diluted to volume in a 50 mL volumetric flask with 17 Mohm DI H_2O . The samples were mixed well and small aliquots were removed for acid titration. This titration was performed to obtain a quantitative acid value for reference in the chemical separation procedures.

Plutonium Isotopes

Aliquots of the dissolution were removed from the primary solution and adjusted to 2.5 M HNO_3 with DI H_2O . These aliquots were spiked with ^{236}Pu or ^{242}Pu tracer and the oxidation state of the plutonium was adjusted to Pu^{+4} . The plutonium was then chemically separated from the rest of the matrix via extraction chromatography. Nd^{+3} and HF were added to the stripped solution and the plutonium was co-precipitated with NdF_3 as PuF_4 . The precipitate was collected onto a 0.1 micron filter and dried. The filter was analyzed by alpha spectrometry (Ortec Soloist counters coupled to Sun Microsystems workstation) and the plutonium isotope concentrations were quantified. All values were corrected for chemical yield via the Pu tracer and are reported in units of dps/g of sample.

After dissolution, a subset of the samples was filtered through a 0.2 micron filter to remove any insoluble oxides of plutonium that might be present. These filters were then put into solution by high temperature fusion and plutonium was separated and analyzed by the method previously described. These results are reported in units of dps/g of sample and are designated with an asterisk in the Summary Data Report (Form I).

Neptunium-237

Aliquots of the dissolution were removed from the primary solution and adjusted to 2.5 M HNO_3 with DI H_2O . The oxidation state of the neptunium was adjusted to Np^{+4} and the sample was passed through an extraction chromatography column to extract neptunium. The neptunium fraction was eluted and this solution was used for the quantitative determination of ^{237}Np by ICPMS (VG Plasma Quad PQ+). Neptunium-239 was also used as a tracer to determine analytical yield through the separation procedure. The ^{239}Np was determined by gamma spectroscopy prior to ICPMS analysis and this value was used to correct for chemical loss in calculation of the final ^{237}Np result. The neptunium values are reported as dps/g of sample.

Americium-241

Aliquots of the dissolution were removed from the primary solution and adjusted to 2.5 M HNO_3 with DI H_2O . These aliquots were spiked with ^{243}Am tracer and then chemically separated from the rest of the matrix via extraction chromatography. The americium fraction was eluted from the extraction column and Nd^{+3} and HF were added to the stripped solution to co-precipitate the americium as AmF_3 . The precipitate was collected onto a 0.1 micron filter and dried. The filter was analyzed by alpha spectrometry (Ortec Soloist counters coupled to Sun Microsystems workstation) and the ^{241}Am isotope concentration was quantified. All values were corrected for chemical yield via the ^{243}Am tracer and are reported in units of dps/g of sample.

Technetium-99

Aliquots of the dissolution were removed and diluted by a factor of 100. ^{115}In was added to give a final solution concentration of 100 $\mu\text{g/L}$ ^{115}In in all samples and standards. All determinations were performed via ICPMS (VG Plasma Quad PQ+) and values are reported in units of dps/g of sample.

^{99}Tc suffers from an isobaric interference with ^{99}Ru and a molecular interference due to $\text{Mo}(98)\text{H}^+$. Ruthenium and ^{98}Mo were monitored on all samples. Ruthenium was not detected in the samples at mass 102 or 104. Molybdenum was detected in some samples at mass 98, but not at levels requiring a correction.

Gamma Spectroscopy

Five milliliter sample aliquots were analyzed on detectors 4 and 5 in the INTEC gamma spectroscopy lab. These detectors are standard p-type coaxial germanium units. The samples were counted 0.5 hours on top of the detector.

The sample spectra were analyzed by the computer program resident on the lab computer. For this suite of samples fission and activation product isotopes were to be measured by gamma spectrometry. Instrumental background spectra were accumulated on these

detector systems prior to use for these samples. After background subtraction, no detectable gamma emitters were found in these samples.

SDG No# W05199031RH

INTEC RADIOCHEMISTRY

**Raw Data Summary - Cover page, Forms I, II, III
For:**

Am241, Np237, Tc99, Pu238 and Pu239/240

INTEC RADIOCHEMISTRY LABORATORY

COVER PAGE

RADIOCHEMISTRY ANALYSES DATA PACKAGE

Project Title: SMC BILLETS

SDG number: W05199031RH

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Report No.: INEEL/INT-99-01228

Approved SAP No.: WGS-051-99

INEEL ID No.	Lab Sample ID No.	INEEL ID No.	Lab Sample ID No.
W05199031RH	9CC97	W05199251RH	9CE31
W05199041RH	9CC98	W05199261RH	9CE32
W05199071RH	9CC99	W05199271RH	9CE33
W05199081RH	9CD01	W05199281RH	9CE34
W05199091RH	9CD02	W05199291RH	9CE35
W05199101RH	9CD03	W05199301RH	9CE36
W05199111RH	9CD04	W05199311RH	9CE37
W05199121RH	9CD05	W05199321RH	9CE38
W05199131RH	9CD06	W05199331RH	9CE39
W05199141RH	9CD07	W05199341RH	9CE40
W05199171RH	9CD08	W05199011RH	9CE41
W05199181RH	9CD09	W05199021RH	9CE42
W05199191RH	9CD10	W05199051RH	9CE43
W05199201RH	9CD11	W05199061RH	9CE44
W05199221RH	9CE28	W05199151RH	9CE45
W05199231RH	9CE29	W05199161RH	9CE46
W05199241RH	9CE30	W05199351RH	9CF20

Comments:

Release of data contained in this data package has been authorized by the laboratory manager or the manager's designee, as verified by the following signature:

Signature: 

Name: Troy Tranter

Title:

Advisory Scientist

Date: Tuesday, December 14, 1999

INTEC RADIOCHEMISTRY LABORATORY

COVER PAGE

RADIOCHEMISTRY ANALYSES DATA PACKAGE

Project Title: SMC BILLETS

SDG number: W05199031RH

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Report No.: INEEL/INT-99-01228

Approved SAP No.: WGS-051-99

INEEL ID No.	Lab Sample ID No.	INEEL ID No.	Lab Sample ID No.
W05199361RH	9CF21	W05199531RH	9CF41
W05199371RH	9CF22	W05199541RH	9CF42
W05199381RH	9CF23	W05199551RH	9CF43
W05199391RH	9CF24	W05199561RH	9CF44
W05199401RH	9CF25	W05199571RH	9CF45
W05199411RH	9CF26	W05199581RH	9CF46
W05199421RH	9CF27	W05199591RH	9CF47
W05199431RH	9CF28	W05199601RH	9CF48
W05199441RH	9CF29	W05199611RH	9CF49
W05199451RH	9CF30	W05199621RH	9CF50
W05199461RH	9CF31	W05199211RH	9CF51
W05199491RH	9CF32		
W05199501RH	9CF33		
W05199471RH	9CF34		
W05199481RH	9CF35		
W05199511RH	9CF39		
W05199521RH	9CF40		

Comments:

Release of data contained in this data package has been authorized by the laboratory manager or the manager's designee, as verified by the following signature:

Signature: 
 Title: Advisory Scientist

Name: Troy Tranter

Date: Tuesday, December 14, 1999

INTEC RADIOCHEMISTRY LABORATORY

FORM I: Analysis Results

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Approved SAP No.: WGS-051-99

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH

Sample Date: 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199031RH	9CC97	Solid	Am241	ALPHA	1.63E-01	2.04E-01	dB/g	1.854	g	101.3	1.92E-01	
			Po238	ALPHA	1.71E-02	3.63E-03	dB/g	1.854	g	102.6	5.14E-03	
			Po238*	ALPHA	5.12E-04	7.48E-04	dB/g	1.854	g	98.6	1.12E-03	
			Po239/240	ALPHA	2.11E-02	4.21E-03	dB/g	1.854	g	102.6	5.74E-03	
			Po239/240*	ALPHA	-3.94E-05	6.33E-05	dB/g	1.854	g	98.6	7.93E-04	
			Np237	ICP-MS	1.38E-01	3.42E-02	dB/g	1.854	g	85.0	6.05E-02	
			Tc99	ICP-MS	<1.40E+00	NA	dB/g	1.854	g	NA	3.40E+00	
			Am241	ALPHA	1.16E-01	5.01E-02	dB/g	2.068	g	101.0	1.02E-01	
			Po238	ALPHA	1.67E-02	4.09E-03	dB/g	2.068	g	57.7	4.45E-03	
			Po238*	ALPHA	1.24E-05	2.76E-05	dB/g	2.068	g	100.9	8.42E-04	
W05199041RH	9CC98	Solid	Po239/240	ALPHA	2.16E-02	5.90E-03	dB/g	2.068	g	57.7	7.07E-03	
			Po239/240*	ALPHA	6.96E-04	7.88E-04	dB/g	2.068	g	100.9	7.01E-04	
			Np237	ICP-MS	7.02E-02	3.03E-02	dB/g	2.068	g	87.3	5.29E-02	
			Tc99	ICP-MS	<3.05E+00	NA	dB/g	2.068	g	NA	3.05E+00	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/TNT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199071RH	9CC99	Solid	Am241	ALPHA	0.00E+00	6.80E-02	dis/g	2.459	g	40.8	2.72E-01	
			Pu238	ALPHA	4.41E-02	1.79E-02	dis/g	2.459	g	100.0	4.40E-03	
			Pu239*	ALPHA	0.00E+00	3.35E-05	dis/g	2.459	g	100.2	1.34E-04	
			Pu239/240	ALPHA	9.84E-02	3.27E-02	dis/g	2.459	g	100.0	7.97E-03	
			Pu239/240*	ALPHA	8.50E-04	3.16E-04	dis/g	2.459	g	100.2	5.24E-04	
			Np237	ICP-MS	9.40E-02	2.90E-02	dis/g	2.459	g	78.1	4.97E-02	
			Tc99	ICP-MS	3.72E+00	1.45E+00	dis/g	2.459	g	NA	2.56E+00	
			Am241	ALPHA	6.41E-02	8.68E-02	dis/g	2.159	g	102.8	9.79E-02	
			Pu238	ALPHA	7.57E-02	1.97E-02	dis/g	2.159	g	103.8	2.40E-03	
			Pu239/240	ALPHA	2.19E-02	3.78E-03	dis/g	2.159	g	103.8	2.40E-03	
W05199081RH	9CD01	Solid	Np237	ICP-MS	1.24E-01	3.15E-02	dis/g	2.159	g	79.8	5.50E-02	
			Tc99	ICP-MS	<2.92E+00	NA	dis/g	2.159	g	NA	2.92E+00	
			Am241	ALPHA	6.04E-02	8.94E-02	dis/g	1.856	g	104.9	2.07E-01	
			Pu238	ALPHA	1.19E-02	4.26E-03	dis/g	1.856	g	62.2	9.66E-03	
			Pu239/240	ALPHA	9.83E-03	1.32E-02	dis/g	1.856	g	62.2	1.47E-02	
			Np237	ICP-MS	1.19E-01	3.80E-02	dis/g	1.856	g	79.2	6.40E-02	
			Tc99	ICP-MS	<3.39E+00	NA	dis/g	1.856	g	NA	3.39E+00	
			Am241	ALPHA	1.06E-01	1.34E-01	dis/g	2.336	g	106.9	1.27E-01	
W05199091RH	9CD02	Solid	Am241	ALPHA	6.04E-02	8.94E-02	dis/g	1.856	g	104.9	2.07E-01	
			Pu238	ALPHA	1.19E-02	4.26E-03	dis/g	1.856	g	62.2	9.66E-03	
			Pu239/240	ALPHA	9.83E-03	1.32E-02	dis/g	1.856	g	62.2	1.47E-02	
			Np237	ICP-MS	1.19E-01	3.80E-02	dis/g	1.856	g	79.2	6.40E-02	
			Tc99	ICP-MS	<3.39E+00	NA	dis/g	1.856	g	NA	3.39E+00	
			Am241	ALPHA	1.06E-01	1.34E-01	dis/g	2.336	g	106.9	1.27E-01	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/JNT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199101RH	9CD03	Solid	Pu238	ALPHA	1.21E-02	2.58E-03	dB/g	2.336	g	100.8	2.84E-03	
			Pu239/240	ALPHA	2.46E-02	4.05E-03	dB/g	2.336	g	100.8	3.10E-03	
			Np237	ICP-MS	5.04E-02	2.53E-02	dB/g	2.336	g	87.6	4.66E-02	
			Tc99	ICP-MS	5.52E+00	1.56E+00	dB/g	2.336	g	NA	2.70E+00	
			Am241	ALPHA	1.35E-01	5.27E-02	dB/g	2.118	g	106.2	9.86E-02	
			Pu238	ALPHA	6.94E-03	2.17E-03	dB/g	2.118	g	94.4	4.13E-03	
			Pu239/240	ALPHA	1.02E-02	2.55E-03	dB/g	2.118	g	94.4	3.63E-03	
			Np237	ICP-MS	<5.97E-02	NA	dB/g	2.118	g	75.5	5.97E-02	
			Tc99	ICP-MS	<2.97E+00	NA	dB/g	2.118	g	NA	2.97E+00	
W05199121RH	9CD05	Solid	Am241	ALPHA	1.55E-01	6.36E-02	dB/g	2.149	g	110.5	1.45E-01	
			Pu238	ALPHA	3.42E-03	5.00E-03	dB/g	2.149	g	47.4	9.59E-03	
			Pu239/240	ALPHA	1.24E-02	4.57E-03	dB/g	2.149	g	47.4	1.04E-02	
			Np237	ICP-MS	6.33E-02	3.05E-02	dB/g	2.149	g	80.4	5.52E-02	
			Tc99	ICP-MS	<2.99E+00	NA	dB/g	2.149	g	NA	2.93E+00	
			Am241	ALPHA	-2.97E-02	4.76E-02	dB/g	2.289	g	103.4	1.60E-01	
			Pu238	ALPHA	4.58E-03	1.58E-03	dB/g	2.289	g	87.3	2.65E-03	
			Pu239/240	ALPHA	1.16E-02	2.87E-03	dB/g	2.289	g	87.3	4.22E-03	
			Np237	ICP-MS	6.48E-02	2.83E-02	dB/g	2.289	g	84.1	4.96E-02	
W05199131RH	9CD06	Solid	Am241	ALPHA	-2.97E-02	4.76E-02	dB/g	2.289	g	103.4	1.60E-01	
			Pu238	ALPHA	4.58E-03	1.58E-03	dB/g	2.289	g	87.3	2.65E-03	
			Pu239/240	ALPHA	1.16E-02	2.87E-03	dB/g	2.289	g	87.3	4.22E-03	
			Np237	ICP-MS	6.48E-02	2.83E-02	dB/g	2.289	g	84.1	4.96E-02	
			Am241	ALPHA	-2.97E-02	4.76E-02	dB/g	2.289	g	103.4	1.60E-01	
			Pu238	ALPHA	4.58E-03	1.58E-03	dB/g	2.289	g	87.3	2.65E-03	
			Pu239/240	ALPHA	1.16E-02	2.87E-03	dB/g	2.289	g	87.3	4.22E-03	
			Np237	ICP-MS	6.48E-02	2.83E-02	dB/g	2.289	g	84.1	4.96E-02	
			Am241	ALPHA	-2.97E-02	4.76E-02	dB/g	2.289	g	103.4	1.60E-01	

Wednesday, December 15, 1999

*** Fusion prep performed for these analyses.**

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199131RH	9CD06	Solid	Tc99	ICP-MS	<2.75E+00	NA	dis/g	2.289	g	NA	2.75E+00	
W05199141RH	9CD07	Solid	Am241	ALPHA	8.89E-02	1.09E-01	dis/g	2.070	g	103.7	9.97E-02	
		Solid	Pu238	ALPHA	1.26E-03	1.91E-03	dis/g	2.070	g	78.2	7.49E-03	
		Solid	Pu239/240	ALPHA	-4.33E-02	7.11E-02	dis/g	2.070	g	78.2	1.30E-02	
		Solid	Np237	ICP-MS	<5.50E-02	NA	dis/g	2.070	g	83.8	5.50E-02	
		Solid	Tc99	ICP-MS	<3.04E+00	NA	dis/g	2.070	g	NA	3.04E+00	
W05199171RH	9CD08	Solid	Am241	ALPHA	8.74E-02	1.20E-01	dis/g	2.021	g	104.1	1.41E-01	
		Solid	Pu238	ALPHA	9.73E-03	2.49E-03	dis/g	2.021	g	86.7	5.64E-03	
		Solid	Pu239/240	ALPHA	1.37E-02	3.15E-03	dis/g	2.021	g	86.7	3.79E-03	
		Solid	Np237	ICP-MS	<5.68E-02	NA	dis/g	2.021	g	83.0	5.68E-02	
		Solid	Tc99	ICP-MS	<1.12E+00	NA	dis/g	2.021	g	NA	3.12E+00	
W05199181RH	9CD09	Solid	Am241	ALPHA	5.41E-02	7.38E-02	dis/g	1.962	g	103.5	8.57E-02	
		Solid	Pu238	ALPHA	5.11E-03	6.91E-03	dis/g	1.962	g	72.6	7.83E-03	
		Solid	Pu239/240	ALPHA	9.55E-03	1.18E-02	dis/g	1.962	g	72.6	1.09E-02	
		Solid	Np237	ICP-MS	<5.86E-02	NA	dis/g	1.962	g	83.0	5.86E-02	
		Solid	Tc99	ICP-MS	<1.21E+00	NA	dis/g	1.962	g	NA	3.21E+00	
W05199191RH	9CD10	Solid	Am241	ALPHA	0.00E+00	5.30E-02	dis/g	2.057	g	102.0	2.07E-01	
		Solid	Pu238	ALPHA	4.20E-03	4.59E-03	dis/g	2.057	g	90.7	4.22E-03	

Wednesday, December 15, 1999

• Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199191RH	9CD10	Solid	Pu239/240	ALPHA	5.30E-03	5.97E-03	dis/g	2.057	g	90.7	5.40E-03	
		Solid	Np237	ICP-MS	<1.65E-02	NA	dis/g	2.057	g	82.1	5.65E-02	
		Solid	Tc99	ICP-MS	<3.06E+00	NA	dis/g	2.057	g	NA	3.06E+00	
W05199201RH	9CD11	Solid	Am241	ALPHA	7.87E-02	1.11E-01	dis/g	2.111	g	99.0	1.52E-01	
		Solid	Pu238	ALPHA	8.63E-03	2.74E-03	dis/g	2.111	g	62.8	4.15E-03	
		Solid	Pu239/240	ALPHA	6.67E-03	2.73E-03	dis/g	2.111	g	62.8	6.21E-03	
W0519921RH	9CE28	Solid	Np237	ICP-MS	<6.10E-02	NA	dis/g	2.111	g	74.1	6.10E-02	
		Solid	Tc99	ICP-MS	<2.98E+00	NA	dis/g	2.111	g	NA	2.98E+00	
		Solid	Am241	ALPHA	4.55E-01	1.09E-01	dis/g	1.819	g	103.7	1.12E-01	
W05199221RH	9CE29	Solid	Pu238	ALPHA	8.39E-03	3.20E-03	dis/g	1.819	g	100.9	7.67E-03	
		Solid	Pu238*	ALPHA	9.94E-05	1.52E-04	dis/g	1.786	g	99.5	4.48E-04	
		Solid	Pu239/240	ALPHA	1.25E-02	3.79E-03	dis/g	1.819	g	100.9	7.96E-03	
W05199231RH	9CE29	Solid	Pu239/240*	ALPHA	8.53E-04	3.21E-04	dis/g	1.786	g	99.5	1.93E-04	
		Solid	Np237	ICP-MS	<6.50E-02	NA	dis/g	1.819	g	82.7	6.50E-02	
		Solid	Tc99	ICP-MS	<3.46E+00	NA	dis/g	1.819	g	NA	3.46E+00	
W05199241RH	9CE29	Solid	Am241	ALPHA	7.12E-01	2.14E-01	dis/g	1.786	g	46.9	3.50E-01	
		Solid	Pu238	ALPHA	6.08E-03	7.92E-03	dis/g	1.786	g	98.6	7.85E-03	
		Solid	Pu239/240	ALPHA	7.92E-03	3.18E-03	dis/g	1.786	g	98.6	7.69E-03	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Approved SAP No.: WGS-051-99

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH

Sample Date: 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199231RH	9CE29	Solid	Np237	ICP-MS	<7.51E-02	NA	ds/g	1.786	g	72.9	7.51E-02	
			Tc99	ICP-MS	<1.53E+00	NA	ds/g	1.786	g	NA	3.53E+00	
			Am241	ALPHA	1.97E-01	8.21E-02	ds/g	2.060	g	77.6	1.82E-01	
			Pu238	ALPHA	8.23E-03	2.39E-03	ds/g	2.060	g	102.7	4.17E-03	
			Pu238*	ALPHA	-1.13E-04	1.86E-04	ds/g	2.060	g	96.9	5.64E-04	
W05199241RH	9CE30	Solid	Pu239/240	ALPHA	7.28E-03	2.11E-03	ds/g	2.060	g	102.7	3.17E-03	
			Pu239/240*	ALPHA	6.31E-04	7.70E-04	ds/g	2.060	g	96.9	6.79E-04	
			Np237	ICP-MS	<6.69E-02	NA	ds/g	2.060	g	71.0	6.69E-02	
			Tc99	ICP-MS	<1.06E+00	NA	ds/g	2.060	g	NA	3.06E+00	
			Am241	ALPHA	1.25E-01	5.36E-02	ds/g	2.646	g	86.9	1.19E-01	
W05199251RH	9CE31	Solid	Pu238	ALPHA	5.29E-03	1.91E-03	ds/g	2.646	g	74.6	3.70E-03	
			Pu239/240	ALPHA	1.58E-02	3.43E-03	ds/g	2.646	g	74.6	3.40E-03	
			Np237	ICP-MS	<4.99E-02	NA	ds/g	2.646	g	74.1	4.99E-02	
			Tc99	ICP-MS	<2.38E+00	NA	ds/g	2.646	g	NA	2.38E+00	
			Am241	ALPHA	8.42E-02	1.22E-01	ds/g	1.910	g	95.6	2.18E-01	
W05199261RH	9CE32	Solid	Pu238	ALPHA	5.94E-03	7.01E-03	ds/g	1.910	g	86.4	6.28E-03	
			Pu238*	ALPHA	1.32E-04	2.03E-04	ds/g	1.910	g	103.3	7.08E-04	
			Pu239/240	ALPHA	7.87E-03	2.53E-03	ds/g	1.910	g	86.4	4.43E-03	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Approved SAP No.: WGS-051-99

Report No.: INEEL/INT-99-01228

SDC number: W05199031RH

Sample Date: 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199261RH	9CE32	Solid	Pu239/240*	ALPHA	2.50E-04	1.62E-04	ds/g	1.910	g	103.3	5.14E-04	
		Solid	Np237	ICP-MS	<7.19E-02	NA	ds/g	1.910	g	71.2	7.19E-02	
		Solid	Tc99	ICP-MS	<1.30E+00	NA	ds/g	1.910	g	NA	3.30E+00	
		Solid	Am241	ALPHA	1.34E-01	1.92E-01	ds/g	1.832	g	70.1	2.99E-01	
		Solid	Pu238	ALPHA	1.34E-02	1.31E-03	ds/g	1.832	g	93.5	4.33E-03	
W05199271RH	9CE33	Solid	Pu239/240	ALPHA	2.05E-02	4.27E-03	ds/g	1.832	g	93.5	4.34E-03	
		Solid	Np237	ICP-MS	<7.28E-02	NA	ds/g	1.832	g	73.3	7.28E-02	
		Solid	Tc99	ICP-MS	<3.44E+00	NA	ds/g	1.832	g	NA	3.44E+00	
		Solid	Am241	ALPHA	3.54E-02	3.32E-02	ds/g	2.406	g	84.1	1.61E-01	
		Solid	Pu238	ALPHA	6.59E-03	2.23E-03	ds/g	2.406	g	89.9	4.56E-03	
W05199281RH	9CE34	Solid	Pu238*	ALPHA	0.00E+00	1.63E-05	ds/g	2.406	g	101.9	1.45E-04	
		Solid	Pu239/240	ALPHA	4.44E-03	6.17E-03	ds/g	2.406	g	89.9	7.73E-03	
		Solid	Pu239/240*	ALPHA	1.50E-04	2.23E-04	ds/g	2.406	g	101.9	4.18E-04	
		Solid	Np237	ICP-MS	<5.27E-02	NA	ds/g	2.406	g	77.1	5.27E-02	
		Solid	Tc99	ICP-MS	4.04E+00	1.53E+00	ds/g	2.406	g	NA	2.62E+00	
W05199291RH	9CE35	Solid	Am241	ALPHA	-7.35E-03	1.15E-02	ds/g	2.040	g	104.0	2.10E-01	
		Solid	Pu238	ALPHA	7.64E-03	2.59E-03	ds/g	2.040	g	86.7	5.23E-03	
		Solid	Pu239/240	ALPHA	5.93E-03	2.25E-03	ds/g	2.040	g	86.7	4.83E-03	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.:** WGS-051-99

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH **Sample Date:** 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199291RH	9CE35	Solid	Np237	ICP-MS	<6.56E-02	NA	ds/g	2.040	g	73.1	6.56E-02	
		Solid	Tc99	ICP-MS	<3.09E+00	NA	ds/g	2.040	g	NA	3.09E+00	
		Solid	Am241	ALPHA	-6.46E-02	1.04E-01	ds/g	2.223	g	75.5	3.42E-01	
		Solid	Pu238	ALPHA	8.65E-03	2.86E-03	ds/g	2.223	g	84.6	5.91E-03	
		Solid	Pu238*	ALPHA	-1.74E-04	2.38E-04	ds/g	2.223	g	100.6	6.26E-04	
W05199301RH	9CE36	Solid	Pu239/240	ALPHA	1.50E-02	3.85E-03	ds/g	2.223	g	84.6	6.63E-03	
		Solid	Pu239/240*	ALPHA	-6.40E-04	1.09E-03	ds/g	2.223	g	100.6	1.31E-03	
		Solid	Np237	ICP-MS	<5.32E-02	NA	ds/g	2.223	g	82.7	5.32E-02	
		Solid	Tc99	ICP-MS	3.66E+00	1.61E+00	ds/g	2.223	g	NA	2.83E+00	
		Solid	Am241	ALPHA	-5.77E-02	9.32E-02	ds/g	1.924	g	87.7	2.64E-01	
W05199311RH	9CE37	Solid	Pu238	ALPHA	6.22E-03	8.10E-03	ds/g	1.924	g	91.2	8.05E-03	
		Solid	Pu239/240	ALPHA	6.89E-03	8.56E-03	ds/g	1.924	g	91.2	7.89E-03	
		Solid	Np237	ICP-MS	<6.10E-02	NA	ds/g	1.924	g	83.3	6.10E-02	
		Solid	Tc99	ICP-MS	<3.27E+00	NA	ds/g	1.924	g	NA	3.27E+00	
		Solid	Am241	ALPHA	1.14E-01	1.42E-01	ds/g	1.998	g	102.5	1.32E-01	
W05199321RH	9CE38	Solid	Pu238	ALPHA	1.96E-02	4.23E-03	ds/g	1.998	g	79.8	4.22E-03	
		Solid	Pu238*	ALPHA	6.40E-05	1.01E-04	ds/g	1.998	g	106.2	1.07E-03	
		Solid	Pu239/240	ALPHA	1.75E-02	4.03E-03	ds/g	1.998	g	79.8	4.93E-03	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Care No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/INT-99-01228

SDC number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199031RH	9CE38	Solid	Pu239/240*	ALPHA	1.28E-05	2.00E-05	dis/g	1.998	g	106.2	5.73E-04	
		Solid	Np237	ICP-MS	<5.76E-02	NA	dis/g	1.998	g	85.0	5.76E-02	
		Solid	Tc99	ICP-MS	<3.15E+00	NA	dis/g	1.998	g	NA	3.15E+00	
		Solid	Am241	ALPHA	1.40E-01	1.66E-01	dis/g	2.267	g	104.5	1.49E-01	
W05199031RH	9CE39	Solid	Pu238	ALPHA	3.06E-02	5.20E-03	dis/g	2.267	g	88.6	3.90E-03	
		Solid	Pu239/240	ALPHA	1.33E-02	3.04E-03	dis/g	2.267	g	88.6	3.34E-03	
		Solid	Np237	ICP-MS	<6.77E-02	NA	dis/g	2.267	g	63.7	6.77E-02	
		Solid	Tc99	ICP-MS	<2.78E+00	NA	dis/g	2.267	g	NA	2.78E+00	
W05199041RH	9CE40	Solid	Am241	ALPHA	1.48E-01	2.05E-01	dis/g	1.892	g	85.3	2.56E-01	
		Solid	Pu238	ALPHA	7.55E-03	2.93E-03	dis/g	1.892	g	81.6	6.69E-03	
		Solid	Pu238*	ALPHA	-1.41E-05	2.25E-05	dis/g	1.892	g	95.1	1.07E-03	
		Solid	Pu239/240	ALPHA	1.81E-02	4.07E-03	dis/g	1.892	g	81.6	4.33E-03	
W05199041RH	9CE41	Solid	Pu239/240*	ALPHA	3.67E-04	5.42E-04	dis/g	1.892	g	95.1	9.11E-04	
		Solid	Np237	ICP-MS	<6.30E-02	NA	dis/g	1.892	g	82.1	6.30E-02	
		Solid	Tc99	ICP-MS	<3.33E+00	NA	dis/g	1.892	g	NA	3.33E+00	
		Solid	Am241	ALPHA	7.50E-02	1.03E-01	dis/g	2.567	g	105.8	1.23E-01	
W05199041RH	9CE41	Solid	Pu238	ALPHA	-1.26E-03	2.05E-03	dis/g	2.567	g	102.6	4.92E-03	
		Solid	Pu239/240	ALPHA	1.28E-02	2.72E-03	dis/g	2.567	g	102.6	2.13E-03	

Wednesday, December 15, 1999 * Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Approved SAP No.: WGS-051-99

Report No.: INEEL/INT-99-01228

SDG number: W0519903IRH

Sample Date: 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W0519901IRH	9CB41	Solid	Np237	ICP-MS	<5.12E-02	NA	ds/g	2.567	g	74.4	5.12E-02	
		Solid	Te99	ICP-MS	3.98E+00	1.44E+00	ds/g	2.567	g	NA	2.45E+00	
		Solid	Am241	ALPHA	9.38E-02	3.97E-02	ds/g	2.611	g	106.9	7.91E-02	
		Solid	Pu238	ALPHA	3.07E-03	4.09E-03	ds/g	2.611	g	73.9	4.24E-03	
		Solid	Pu239*	ALPHA	-1.26E-04	2.06E-04	ds/g	2.611	g	100.1	7.12E-04	
W0519902IRH	9CB42	Solid	Pu239/240	ALPHA	8.69E-03	2.68E-03	ds/g	2.611	g	73.9	4.55E-03	
		Solid	Pu239/240*	ALPHA	1.07E-04	1.65E-04	ds/g	2.611	g	100.1	6.27E-04	
		Solid	Np237	ICP-MS	<4.78E-02	NA	ds/g	2.611	g	78.3	4.78E-02	
		Solid	Te99	ICP-MS	4.66E+00	1.40E+00	ds/g	2.611	g	NA	2.41E+00	
		Solid	Am241	ALPHA	2.05E-02	3.13E-02	ds/g	2.169	g	106.6	1.36E-01	
W0519905IRH	9CB43	Solid	Pu238	ALPHA	1.06E-03	1.63E-03	ds/g	2.169	g	73.3	6.62E-03	
		Solid	Pu239/240	ALPHA	-8.19E-04	1.31E-03	ds/g	2.169	g	73.3	9.19E-03	
		Solid	Np237	ICP-MS	<5.69E-02	NA	ds/g	2.169	g	79.2	5.69E-02	
		Solid	Te99	ICP-MS	<2.90E+00	NA	ds/g	2.169	g	NA	2.90E+00	
		Solid	Am241	ALPHA	5.91E-02	8.38E-02	ds/g	2.340	g	107.0	1.17E-01	
W0519906IRH	9CB44	Solid	Pu238	ALPHA	2.13E-03	2.71E-03	ds/g	2.340	g	91.7	2.53E-03	
		Solid	Pu238*	ALPHA	6.51E-05	1.01E-04	ds/g	2.340	g	99.6	4.86E-04	
		Solid	Pu239/240	ALPHA	2.13E-03	2.71E-03	ds/g	2.340	g	91.7	2.54E-03	

Wednesday, December 15, 1999

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199061RH	9CE44	Solid	Pu239/240*	ALPHA	9.56E-04	3.41E-04	dB/g	2.340	g	99.6	5.39E-04	
		Solid	Np237	ICP-MS	<5.85E-02	NA	dB/g	2.340	g	71.4	5.85E-02	
		Solid	Tc99	ICP-MS	<2.69E+00	NA	dB/g	2.340	g	NA	2.69E+00	
		Solid	Am241	ALPHA	-1.68E-02	2.66E-02	dB/g	2.213	g	105.4	2.49E-01	
W05199151RH	9CE45	Solid	Pu238	ALPHA	3.95E-03	1.49E-03	dB/g	2.213	g	94.7	2.58E-03	
		Solid	Pu239/240	ALPHA	1.59E-02	3.39E-03	dB/g	2.213	g	94.7	2.98E-03	
		Solid	Np237	ICP-MS	<6.05E-02	NA	dB/g	2.213	g	73.1	6.05E-02	
		Solid	Tc99	ICP-MS	3.85E+00	1.64E+00	dB/g	2.213	g	NA	2.85E+00	
W05199161RH	9CE46	Solid	Am241	ALPHA	8.48E-02	1.22E-01	dB/g	1.934	g	105.5	1.97E-01	
		Solid	Pu238	ALPHA	5.19E-03	6.58E-03	dB/g	1.934	g	81.8	6.14E-03	
		Solid	Pu239*	ALPHA	-3.93E-05	6.33E-05	dB/g	1.934	g	99.4	4.13E-04	
		Solid	Pu239/240	ALPHA	1.46E-02	3.40E-03	dB/g	1.934	g	81.8	5.13E-03	
W05199051RH	9CF70	Solid	Pu239/240*	ALPHA	2.23E-04	3.36E-04	dB/g	1.934	g	99.4	7.56E-04	
		Solid	Np237	ICP-MS	<6.17E-02	NA	dB/g	1.934	g	81.9	6.17E-02	
		Solid	Tc99	ICP-MS	8.73E+00	1.75E+00	dB/g	1.934	g	NA	3.26E+00	
		Solid	Am241	ALPHA	7.24E-02	1.03E-01	dB/g	2.006	g	100.9	1.43E-01	
W05199051RH	9CF70	Solid	Pu238	ALPHA	2.65E-03	3.75E-03	dB/g	2.006	g	91.3	5.15E-03	
		Solid	Pu239/240	ALPHA	2.15E-02	4.41E-03	dB/g	2.006	g	91.3	4.38E-03	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY **Case No.:** NA **Approved SAP No.:** WGS-051-99
Report No.: INEEL/INT-99-01228 **SDG number:** W05199031RH **Sample Date:** 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199351RH	9CF20	Solid	Np237	ICP-MS	<5.79E-02	NA	ds/g	2.006	g	84.2	5.79E-02	
			Tc99	ICP-MS	8.69E+00	1.67E+00	ds/g	2.006	g	NA	3.14E+00	
			Am241	ALPHA	1.22E-01	1.43E-01	ds/g	2.186	g	104.5	1.28E-01	
			Pu238	ALPHA	3.18E-03	3.69E-03	ds/g	2.186	g	87.4	3.28E-03	
			Pu239/240	ALPHA	7.82E-03	2.32E-03	ds/g	2.186	g	87.4	3.29E-03	
W05199161RH	9CF21	Solid	Np237	ICP-MS	6.17E-02	2.67E-02	ds/g	2.186	g	93.9	4.66E-02	
			Tc99	ICP-MS	3.50E+00	1.62E+00	ds/g	2.186	g	NA	2.88E+00	
			Am241	ALPHA	7.85E-02	1.13E-01	ds/g	2.057	g	99.2	1.82E-01	
			Pu238	ALPHA	1.93E-03	2.81E-03	ds/g	2.057	g	18.6	4.67E-03	
			Pu239/240	ALPHA	1.52E-02	3.57E-03	ds/g	2.057	g	88.6	4.23E-03	
W05199071RH	9CF22	Solid	Np237	ICP-MS	<5.55E-02	NA	ds/g	2.057	g	85.7	5.55E-02	
			Tc99	ICP-MS	4.57E+00	1.78E+00	ds/g	2.057	g	NA	3.06E+00	
			Am241	ALPHA	5.73E-02	8.50E-02	ds/g	1.767	g	104.2	1.88E-01	
			Pu238	ALPHA	4.55E-03	2.06E-03	ds/g	1.767	g	72.0	4.25E-03	
			Pu239/240	ALPHA	1.59E-02	4.13E-03	ds/g	1.767	g	72.0	4.92E-03	
W05199081RH	9CF23	Solid	Np237	ICP-MS	<7.38E-02	NA	ds/g	1.767	g	75.0	7.38E-02	
			Tc99	ICP-MS	<3.56E+00	NA	ds/g	1.767	g	NA	3.56E+00	
			Am241	ALPHA	9.31E-02	1.37E-01	ds/g	2.074	g	101.6	2.75E-01	

Wednesday, December 15, 1999 * Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Report No.: INEEL/INT-99-01228

Case No.: NA **Approved SAP No.: WGS-051-99**

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W0519901RH	9CF24	Solid	Pu238	ALPHA	7.86E-03	2.64E-03	ds/g	2.074	g	81.7	4.90E-03	
		Solid	Pu239/240	ALPHA	2.57E-02	5.04E-03	ds/g	2.074	g	81.7	3.77E-03	
		Solid	Np237	ICP-MS	<6.75E-02	NA	ds/g	2.074	g	69.9	6.75E-02	
		Solid	Te99	ICP-MS	6.09E+00	1.76E+00	ds/g	2.074	g	NA	3.04E+00	
		Solid	Am241	ALPHA	1.26E-01	1.72E-01	ds/g	1.937	g	104.8	1.98E-01	
W05199041RH	9CF25	Solid	Pu238	ALPHA	2.53E-03	1.18E-03	ds/g	1.937	g	97.0	2.16E-03	
		Solid	Pu239/240	ALPHA	1.23E-02	2.92E-03	ds/g	1.937	g	97.0	9.28E-04	
		Solid	Np237	ICP-MS	<8.01E-02	NA	ds/g	1.937	g	63.0	8.01E-02	
		Solid	Te99	ICP-MS	8.43E+00	1.77E+00	ds/g	1.937	g	NA	3.25E+00	
		Solid	Am241	ALPHA	1.12E-01	1.34E-01	ds/g	2.156	g	99.5	1.20E-01	
W05199041RH	9CF26	Solid	Pu238	ALPHA	7.75E-03	2.36E-03	ds/g	2.156	g	89.3	3.63E-03	
		Solid	Pu239/240	ALPHA	2.19E-02	4.32E-03	ds/g	2.156	g	89.3	2.63E-03	
		Solid	Np237	ICP-MS	<5.71E-02	NA	ds/g	2.156	g	79.4	5.71E-02	
		Solid	Te99	ICP-MS	1.99E+01	1.18E+00	ds/g	2.156	g	NA	2.92E+00	
		Solid	Am241	ALPHA	1.62E-01	1.80E-01	ds/g	2.045	g	99.8	1.64E-01	
W051990421RH	9CF27	Solid	Pu238	ALPHA	3.27E-03	4.15E-03	ds/g	2.045	g	106.5	3.89E-03	
		Solid	Pu239/240	ALPHA	1.64E-02	3.58E-03	ds/g	2.045	g	106.5	4.15E-03	
		Solid	Np237	ICP-MS	<5.14E-02	NA	ds/g	2.045	g	91.0	5.14E-02	

Wednesday, December 15, 1999

* Fusion prep performed for these analytes.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199421RH	9CF27	Solid	Tc99	ICP-MS	5.83E+00	1.80E+00	ds/g	2.045	g	NA	3.08E+00	
	9CF28	Solid	Am241	ALPHA	3.87E-02	5.55E-02	ds/g	2.082	g	99.6	8.50E-02	
		Solid	Pu238	ALPHA	2.43E-04	3.78E-04	ds/g	2.082	g	105.9	5.88E-03	
		Solid	Pu239/240	ALPHA	1.37E-02	3.00E-03	ds/g	2.082	g	105.9	2.00E-03	
		Solid	Np237	ICP-MS	<5.63E-02	NA	ds/g	2.082	g	83.4	5.63E-02	
W05199441RH	9CF29	Solid	Tc99	ICP-MS	<3.03E+00	NA	ds/g	2.082	g	NA	3.03E+00	
		Solid	Am241	ALPHA	1.44E-02	2.23E-02	ds/g	2.028	g	103.0	1.72E-01	
		Solid	Pu238	ALPHA	2.98E-03	4.02E-03	ds/g	2.028	g	99.8	4.34E-03	
		Solid	Pu239/240	ALPHA	6.35E-03	2.29E-03	ds/g	2.028	g	99.8	4.62E-03	
		Solid	Np237	ICP-MS	6.48E-02	3.05E-02	ds/g	2.028	g	88.2	5.47E-02	
W05199451RH	9CF30	Solid	Tc99	ICP-MS	6.84E+00	1.77E+00	ds/g	2.028	g	NA	3.11E+00	
		Solid	Am241	ALPHA	5.45E-02	7.19E-02	ds/g	2.422	g	102.3	7.33E-02	
		Solid	Pu238	ALPHA	3.41E-03	1.33E-03	ds/g	2.422	g	102.3	2.54E-03	
		Solid	Pu239/240	ALPHA	8.52E-03	2.21E-03	ds/g	2.422	g	102.3	2.83E-03	
		Solid	Np237	ICP-MS	<4.98E-02	NA	ds/g	2.422	g	81.1	4.98E-02	
W05199461RH	9CF31	Solid	Tc99	ICP-MS	1.22E+01	1.07E+00	ds/g	2.422	g	NA	2.60E+00	
		Solid	Am241	ALPHA	9.68E-02	1.15E-01	ds/g	2.457	g	101.1	1.03E-01	
		Solid	Pu238	ALPHA	6.22E-03	2.53E-03	ds/g	2.457	g	61.2	5.44E-03	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/JNT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQR
W05199461RH	9CF31	Solid	Pu239/240	ALPHA	2.14E-02	4.90E-03	dw/g	2.457	g	61.2	3.62E-03	
			Np237	ICP-MS	<1.99E-02	NA	dw/g	2.457	g	86.7	4.99E-02	
			Tc99	ICP-MS	1.03E+01	1.11E+00	dw/g	2.457	g	NA	2.56E+00	
			Am241	ALPHA	1.86E-01	6.46E-02	dw/g	2.260	g	100.2	1.14E-01	
			Po238	ALPHA	3.46E-03	4.08E-03	dw/g	2.260	g	87.4	3.63E-03	
W05199491RH	9CF32	Solid	Pu239/240	ALPHA	1.11E-02	2.89E-03	dw/g	2.260	g	87.4	3.63E-03	
			Np237	ICP-MS	5.83E-02	2.96E-02	dw/g	2.260	g	79.0	5.48E-02	
			Tc99	ICP-MS	1.00E+01	1.31E+00	dw/g	2.260	g	NA	2.79E+00	
			Am241	ALPHA	6.89E-02	9.89E-02	dw/g	2.249	g	98.5	1.51E-01	
			Po238	ALPHA	5.18E-03	1.83E-03	dw/g	2.249	g	101.2	3.57E-03	
W05199501RH	9CF33	Solid	Pu239/240	ALPHA	1.41E-02	3.04E-03	dw/g	2.249	g	101.2	2.74E-03	
			Np237	ICP-MS	<5.28E-02	NA	dw/g	2.249	g	82.3	5.28E-02	
			Tc99	ICP-MS	1.07E+01	1.10E+00	dw/g	2.249	g	NA	2.80E+00	
			Am241	ALPHA	1.37E-01	4.93E-02	dw/g	2.659	g	99.6	8.30E-02	
			Po238	ALPHA	6.93E-03	1.92E-03	dw/g	2.659	g	104.6	2.84E-03	
W05199471RH	9CF34	Solid	Pu239/240	ALPHA	1.59E-02	3.25E-03	dw/g	2.659	g	104.6	3.59E-03	
			Np237	ICP-MS	<5.14E-02	NA	dw/g	2.659	g	71.6	5.14E-02	
			Tc99	ICP-MS	9.97E+00	1.02E+00	dw/g	2.659	g	NA	2.37E+00	

Wednesday, December 15, 1999

* Fusion prep performed for these analytes.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY **Case No.:** NA **Approved SAP No.:** WGS-051-99
Report No.: INEEL/INT-99-01228 **SDG number:** W05199031RH **Sample Date:** 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199481RH	9CF35	Solid	Am241	ALPHA	9.24E-02	1.20E-01	dis/g	2.480	g	97.7	1.19E-01	
		Solid	Pu238	ALPHA	6.56E-03	2.02E-03	dis/g	2.480	g	101.7	3.64E-03	
		Solid	Pu239/240	ALPHA	2.03E-02	3.82E-03	dis/g	2.480	g	101.7	3.36E-03	
		Solid	Np237	ICP-MS	<4.22E-02	NA	dis/g	2.480	g	93.4	4.22E-02	
		Solid	Tc99	ICP-MS	1.58E+01	1.00E+00	dis/g	2.480	g	NA	2.54E+00	
W05199511RH	9CF39	Solid	Am241	ALPHA	1.20E-01	1.51E-01	dis/g	1.764	g	105.3	1.42E-01	
		Solid	Pu238	ALPHA	3.19E-02	8.61E-03	dis/g	1.764	g	33.1	9.48E-03	
		Solid	Pu239/240	ALPHA	2.23E-02	7.18E-03	dis/g	1.764	g	33.1	1.10E-02	
		Solid	Np237	ICP-MS	<7.93E-02	NA	dis/g	1.764	g	69.9	7.93E-02	
		Solid	Tc99	ICP-MS	<3.57E+00	NA	dis/g	1.764	g	NA	3.57E+00	
W05199521RH	9CF40	Solid	Am241	ALPHA	4.42E-02	6.50E-02	dis/g	1.908	g	100.1	1.95E-01	
		Solid	Pu238	ALPHA	1.63E-02	3.55E-03	dis/g	1.908	g	104.1	4.28E-03	
		Solid	Pu239*	ALPHA	3.46E-04	4.89E-04	dis/g	1.908	g	99.5	5.96E-04	
		Solid	Pu239/240	ALPHA	3.18E-02	5.31E-03	dis/g	1.908	g	104.1	3.29E-03	
		Solid	Pu239/240*	ALPHA	3.60E-04	5.23E-04	dis/g	1.908	g	99.5	7.69E-04	
W05199531RH	9CF41	Solid	Np237	ICP-MS	<6.60E-02	NA	dis/g	1.908	g	77.7	6.60E-02	
		Solid	Tc99	ICP-MS	<3.30E+00	NA	dis/g	1.908	g	NA	3.30E+00	
		Solid	Am241	ALPHA	1.32E-01	1.65E-01	dis/g	1.877	g	103.1	1.53E-01	

Wednesday, December 15, 1999 * Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199531RH	9CF41	Solid	Pu238	ALPHA	1.50E-02	3.48E-03	dw/g	1.877	g	92.0	3.81E-03	
		Solid	Pu239/240	ALPHA	1.96E-02	4.15E-03	dw/g	1.877	g	92.0	4.25E-03	
		Solid	Np237	ICP-MS	<7.05E-02	NA	dw/g	1.877	g	73.9	7.05E-02	
		Solid	Tc99	ICP-MS	5.05E+00	1.96E+00	dw/g	1.877	g	NA	3.36E+00	
		Solid	Am241	ALPHA	1.95E-01	8.09E-02	dw/g	2.019	g	102.0	1.87E-01	
W05199541RH	9CF42	Solid	Pu238	ALPHA	1.76E-02	3.76E-03	dw/g	2.019	g	98.5	4.36E-03	
		Solid	Pu239/240	ALPHA	2.21E-02	4.31E-03	dw/g	2.019	g	98.5	4.90E-03	
		Solid	Np237	ICP-MS	<1.13E-01	NA	dw/g	2.019	g	42.9	1.13E-01	
		Solid	Tc99	ICP-MS	1.23E+01	1.59E+00	dw/g	2.019	g	NA	3.12E+00	
		Solid	Am241	ALPHA	1.33E-01	1.57E-01	dw/g	2.044	g	107.0	1.40E-01	
W05199551RH	9CF43	Solid	Pu238	ALPHA	1.66E-02	3.91E-03	dw/g	2.044	g	103.1	6.61E-03	
		Solid	Pu239/240	ALPHA	2.75E-02	4.69E-03	dw/g	2.044	g	103.1	2.17E-03	
		Solid	Np237	ICP-MS	<6.82E-02	NA	dw/g	2.044	g	70.2	6.82E-02	
		Solid	Tc99	ICP-MS	8.27E+00	1.65E+00	dw/g	2.044	g	NA	3.08E+00	
		Solid	Am241	ALPHA	1.43E-01	6.08E-02	dw/g	1.824	g	100.5	1.21E-01	
W05199561RH	9CF44	Solid	Pu238	ALPHA	6.19E-03	2.37E-03	dw/g	1.824	g	105.2	5.25E-03	
		Solid	Pu238*	ALPHA	-4.45E-05	7.17E-05	dw/g	1.824	g	90.2	4.68E-04	
		Solid	Pu239/240	ALPHA	1.08E-02	2.99E-03	dw/g	1.824	g	105.2	4.98E-03	

Wednesday, December 15, 1999

* Fusion prep performed for these analytes.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Approved SAP No.: WGS-051-99

Report No.: INEEL/INT-99-01228

SDG number: W0519903 IRH

Sample Date: 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199561RH	9CF44	Solid	Pu239/240*	ALPHA	-1.19E-04	1.97E-04	dB/g	1.824	g	93.2	8.55E-04	
		Solid	Np237	ICP-MS	<1.32E-01	NA	dB/g	1.824	g	40.6	1.32E-01	
		Solid	Tc99	ICP-MS	<3.45E+00	NA	dB/g	1.824	g	NA	3.45E+00	
		Solid	Am241	ALPHA	7.16E-02	1.00E-01	dB/g	1.954	g	102.7	1.31E-01	
W05199571RH	9CF45	Solid	Pu238	ALPHA	1.04E-02	2.61E-03	dB/g	1.954	g	102.6	3.22E-03	
		Solid	Pu239/240	ALPHA	8.80E-03	2.38E-03	dB/g	1.954	g	102.6	3.22E-03	
		Solid	Np237	ICP-MS	<7.94E-02	NA	dB/g	1.954	g	63.0	7.94E-02	
		Solid	Tc99	ICP-MS	6.48E+00	1.87E+00	dB/g	1.954	g	NA	3.22E+00	
W05199581RH	9CF46	Solid	Am241	ALPHA	9.08E-02	1.29E-01	dB/g	2.047	g	99.8	1.82E-01	
		Solid	Pu238	ALPHA	1.06E-02	2.56E-03	dB/g	2.047	g	101.0	2.69E-03	
		Solid	Pu239/240	ALPHA	2.20E-02	4.02E-03	dB/g	2.047	g	101.0	2.15E-03	
		Solid	Np237	ICP-MS	<5.51E-02	NA	dB/g	2.047	g	86.7	5.51E-02	
W05199591RH	9CF47	Solid	Tc99	ICP-MS	<3.08E+00	NA	dB/g	2.047	g	NA	3.08E+00	
		Solid	Am241	ALPHA	1.05E-01	4.18E-02	dB/g	2.181	g	104.0	3.15E-02	
		Solid	Pu238	ALPHA	1.99E-02	3.77E-03	dB/g	2.181	g	96.9	2.62E-03	
		Solid	Pu239/240	ALPHA	2.66E-02	4.60E-03	dB/g	2.181	g	96.9	3.03E-03	
		Solid	Np237	ICP-MS	<5.48E-02	NA	dB/g	2.181	g	81.9	5.48E-02	
		Solid	Tc99	ICP-MS	1.33E+01	1.20E+00	dB/g	2.181	g	NA	2.89E+00	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Case No.: NA

Approved SAP No.: WGS-051-99

Report No.: INEEL/INT-99-01228

SDG number: W05199031RH

Sample Date: 10/07/1999

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
W05199601RH	9CF48	Solid	Am241	ALPHA	1.21E-01	4.67E-02	d/s/g	2.563	g	101.1	8.52E-02	
		Solid	Pu238	ALPHA	9.41E-03	2.28E-03	d/s/g	2.563	g	101.6	3.04E-03	
		Solid	Pu238*	ALPHA	1.02E-05	1.61E-05	d/s/g	2.563	g	98.5	4.56E-04	
		Solid	Pu239/240	ALPHA	2.08E-02	3.66E-03	d/s/g	2.563	g	101.6	2.51E-03	
		Solid	Pu239/240*	ALPHA	2.55E-04	1.16E-04	d/s/g	2.563	g	98.5	1.38E-04	
		Solid	Np237	ICP-MS	<4.43E-02	NA	d/s/g	2.563	g	86.1	4.43E-02	
		Solid	Tc99	ICP-MS	1.50E+01	9.48E-01	d/s/g	2.563	g	NA	2.46E+00	
		Solid	Am241	ALPHA	3.69E-02	5.63E-02	d/s/g	1.273	g	101.0	2.45E-01	
		Solid	Pu238	ALPHA	4.89E-03	6.76E-03	d/s/g	1.273	g	70.2	8.21E-03	
		Solid	Pu239/240	ALPHA	0.00E+00	5.00E-04	d/s/g	1.273	g	70.2	1.99E-03	
W05199621RH	9CF50	Solid	Np237	ICP-MS	<1.30E-01	NA	d/s/g	1.273	g	59.3	1.30E-01	
		Solid	Tc99	ICP-MS	<4.95E+00	NA	d/s/g	1.273	g	NA	4.95E+00	
		Solid	Am241	ALPHA	7.40E-02	1.02E-01	d/s/g	2.292	g	102.7	1.24E-01	
		Solid	Pu238	ALPHA	4.69E-03	5.94E-03	d/s/g	2.292	g	64.9	5.59E-03	
		Solid	Pu239/240	ALPHA	-3.56E-04	5.68E-04	d/s/g	2.292	g	64.9	2.97E-03	
		Solid	Np237	ICP-MS	<6.74E-02	NA	d/s/g	2.292	g	63.3	6.74E-02	
		Solid	Tc99	ICP-MS	<2.75E+00	NA	d/s/g	2.292	g	NA	2.75E+00	
		Solid	Am241	ALPHA	1.80E-01	6.93E-02	d/s/g	2.253	g	99.8	1.47E-01	

Wednesday, December 15, 1999

* Fusion prep performed for these analyses.

Project Title: SMC BILLETS

Lab Name: INTEC RADIOCHEMISTRY

Care No.: NA **Approved SAP No.: WGS-051-99**

Report No.: INEEL/INT-99-01228

SDG number: WGS199031RH **Sample Date: 10/07/1999**

INEEL ID No.	Lab Sample ID No.	Matrix	Analyte	Analysis Type	Value	Uncertainty	Units	Sample Size	Unit	Yield%	MDA	DQF
WGS199211RH	9CF51	Solid	Pu238	ALPHA	2.28E-02	4.13E-03	ds/g	2.253	g	104.7	1.90E-03	
		Solid	Pu239/240	ALPHA	3.85E-02	5.88E-03	ds/g	2.253	g	104.7	4.13E-03	
		Solid	Np237	ICP-MS	<5.60E-02	NA	ds/g	2.253	g	77.5	5.60E-02	
		Solid	Tc99	ICP-MS	1.89E+01	1.12E+00	ds/g	2.253	g	NA	2.80E+00	